

SUMMARY

„Impact of working conditions of cogeneration systems on the possibility of restructuring sources of electricity production”

The growing consumption of electricity in the world, global warming and environmental awareness point to the need to save electricity and to promote the use of renewable energy sources.

The dissertation describes the current problems of the Polish energy sector, presenting the requirements of the European Union climate and energy package. In the first part of the dissertation the thesis and the purpose of the work were presented and the topics contained in subsequent chapters of the dissertation were summarized. Next, the impact of the state strategy on electricity producers was described, the energy efficiency of selected generation sources was compared and the technical and economic conditions of electricity generation sources were presented.

Chapter three refers to the description of the current issues of energy market, the role of the electricity consumers and electricity sellers.

The fourth chapter compares the combined and separated energy production, describes the principle of operation of a cogeneration installation based on a natural gas piston engine and the main elements of the cogeneration system were presented. In addition to split production fed with natural gas, selected cogeneration installations powered with atypical gas fuels and the concept of trigeneration allowing the generation of three types of energy as part of the same process of primary energy conversion into usable energy was presented. The last part of the fourth chapter describes the share of cogeneration installations in total electricity production.

Chapter five of the dissertation was devoted to the subject of multi-criteria decision support, as a tool used in the absence of a solution that simultaneously meets all declared selection criteria. Selected optimization methods were described, indicating the main features and the scale of grades used.

Chapter six presents the parameters of the selection of the gas cogeneration system, such as: the structure of the technological and electrical installation of the facility as well as energy performance indicators of the CHP system (average efficiency of electricity

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production, average efficiency of thermal energy production, average total efficiency, association ratio and energy saving original).

Chapter seven of dissertation confirms the second part of the thesis about the legitimacy of creating a computer application for choosing a cogeneration source. The chapter includes a description of the author's program KOGENERACJA 1.0 with a presentation of the main functions and the ability to change parameters and report generation. The developed algorithm of the program in the first part of the research was implemented in the Matlab program for scientific calculations and engineering. In the second stage of research, the algorithm was used to create a window application in the Microsoft Visual C# 2010 on the environment .NET Framework 4 in Visual C#. In addition, the chapter presents the area of program solutions, principles of cooperation of the CHP unit with coal boilers, data values and criteria implemented in the algorithm and the program of selecting an associated power generation unit.

Chapter eight of the dissertation presents the results of the program for the needs of the selected example. The existence of more than one selection criterion (profit, emission of environmentally harmful substances and simple payback time) has been taken into account. The obtained results confirm the first part of the thesis about the possibility and purposefulness of optimization of CHP unit selection using multi-criteria decision support methods and allow comparison of optimization methods used in the aspect of CHP unit selection.

The last part of the dissertation presents the conclusions and summary of the dissertation and the author's own contribution was included.


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